

Ceramic Manufacturing Program

Most ceramic products are produced by powder processing, where raw material powders are mixed with forming additives and shaped by various means into green bodies, which are then fired to the final product. Depending on the intended application, parts may require machining, the costs of which can represent a significant fraction of the total manufacturing cost. Also, because ceramics are susceptible to brittle fracture, the manufacturing steps used in their production must be carefully controlled and/or monitored to ensure that the required properties are obtained. One key to reliable and cost-effective development of new products is the availability of established test methods to analyze the material at its different stages of manufacturing.

The primary objective of the Ceramic Manufacturing Program is to provide measurement techniques, standards, basic data, and predictive models needed by U.S. industry for cost-effective manufacturing of reliable ceramic products. Research activities include off-line and on-line measurement methods needed for processing of ceramic powders and suspensions, and for machining processes applied to ceramics. The research activities are focused on the characterization of particles and of particle suspensions and rheological properties of ceramic slurries, identification of the influence of powder characteristics and processing conditions on the resultant microstructures, homogeneity measurements on pre-sintered ceramics, identification of machining induced damage and the influence of this damage on mechanical properties, and development of test methodologies and mechanistic models of mechanical behavior of ceramics which are required for reliable use in a variety of applications. The results of the research activities in the program are used to develop new measurement methods and Standard Reference Materials that are needed for calibration of measurement instruments used for key manufacturing steps and for reliability analysis. The reliability and precision of various measurement techniques and their suitability for standardization are assessed jointly with industrial partners, international measurement laboratories, and national and international standards organizations. The close working relationship developed between these organizations and NIST not only ensures the relevance of the research projects but also promotes an efficient and timely transfer of research information to industry for implementation.